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SUMMARY
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UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

SUMMARY

Agenda Item : D.

Argentina

INDUSTRIAL DEVELOPMENT POLICIES AND PROBLEMS OF STRUCTURE

By Adolfo DORFMAN

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INDUSTRIAL DEVELOPMENT POLICIES AND PROBLEMS OF STRUCTURE

By
ADOLFO DORFMAN

1. The countries of Latin America are going through a process of structural change which reveals itself in the diversification of agriculture, cattle raising and mining, which were the mainstay of the old structure, and a new emphasis on industrial activity. The scope and reach of these changes vary from country to country, but usually commerce is the sphere in which the biggest changes occur as the bare subsistence level of production and consumption (which is so widespread in regions of native extraction) is only slightly affected and may remain in some cases untouched by the transformations occurring elsewhere. Nevertheless, the social and institutional impact is very great.

2. By 1940 these structural changes were already noticeable in some of the more developed countries of Latin America and, gathering momentum during the war, have since continued with fluctuations. Moreover, they are spreading to countries which in 1940 either had no industrial set-up or one that was in its infancy. The contribution to gross national product of the manufacturing industries in the Latin American countries rose from an average of 12% pre-war to 21% in 1960.

3. Signs of maturity can be seen in the internal industrial structure of the more advanced countries, where by 1940 production of essential consumer goods accounted for over 60% of gross product, but only 45% in 1960. Meanwhile, from a bare 20 to 25% chemicals and metals accounted for 40% in 1960, the greater share going to the heavy industries in this field. By 1960 the structure of production was approximately as follows: consumer goods 50%, unfinished goods 40% (barely half of which were metals and chemicals), capital goods 10%.

4. To understand the nature of these changes in the pattern of industrial production, one must analyse and compare the changes that have been taking place in the pattern of imports. In relative terms, over the last 20 years, Latin American imports of consumer goods fell on average from 50% to 20%, whereas imports of unfinished materials rose from 20% to 40%, capital goods from 20% to 30% and fuels remained steady at 10%.

5. Four characteristic situations may be reached in countries in process of industrialisation: (a) a relatively balanced development of industry, cattle-raising and agriculture (possibly at low and medium levels, helping 'backward linkage' or following an independent course); (b) industrial growth at the expense of agriculture; (c) excessive growth of consumer goods production accompanied by a disproportionate rise in imports of semi-finished and capital goods; and (d) growth of basic capital industries balancing and harmonizing to some extent with growth in the consumer goods sector.

6. Typically, four main stages may be distinguished: (a) 'backward linkage' or original impetus, (b) 'forward linkage' with rising industrial demand, (c) radial expansion through growth of auxiliary industries, and (d) heavy industry. The first stage is the production of easily substituted consumer goods, but its advantages soon disappear because of the relative smallness of domestic markets even in those countries with the highest national income.

7. From the foregoing analysis some important conclusions emerge: (a) Industrialisation begins with intensive substitution of home-made light goods for foreign imports and a consequent increase in imports of essential materials and plant required for their manufacture.

(b) Recent industrial expansion is not the end of 'backward linkage', but stimulates a demand for additional imports.

(c) Immaturity of the industrial structure leads to considerable vulnerability as regards critical supplies.

(d) Consequently, heavy industry is the critical sector, whether as regards integration of consumer goods production or more highly specialized production and capitalization.

(e) Heavy industry (in countries where it has attained a certain level, but where there is an adverse trade balance) at once solves the problem of

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Agenda Item: D.4.1

India

FOOD PRESERVATION AS A MEANS TO CONSERVING SURPLUS AGRICULTURAL AND FISHERIES PRODUCTION FOR DISTRIBUTION AND CONSUMPTION

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FOOD PRESERVATION AS A MEANS TO CONSERVING SURPLUS AGRICULTURAL AND FISHERIES PRODUCTION FOR DISTRIBUTION AND CONSUMPTION

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A significant feature of development in India in recent times has been the wide-spread application of science and technology in the field of food and agriculture. The application is being promoted and extended at all the stages from production through preservation to utilisation. Emphasis is being placed on achieving increased diversification in the food production with simultaneous development, not only of cereals, but also, of legumes, fruits and vegetables, milk, fish and other items needed for a balanced diet. A systematic approach is being made to conserve what is produced by a judicious combination of traditional methods and modern techniques. The different methods of preservation such as preservation by means of drying, fermentation and pickling, sugar, salt, chemical additives, refrigeration and freezing and canning are all encouraged. Preservation with ionizing radiation is only in an experimental stage. In addition, technological aids are also being sought in salvaging for human consumption food from certain potential resources which have not been hitherto adequately utilized. The discussion below will be restricted to a few aspects which will tend to illustrate how the problem is being tackled in India.

FOOD PRESERVATION AS A MEANS TO CONSERVING AVAILABLE FOOD SUPPLIES - INDIAN SITUATION.

The role of food preservation is not readily understood in most of the underdeveloped countries. Even some of the essential measures are often regarded as adding on to the cost of the fresh food and as avoidable. While this type of outlook is gradually

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changing, a large amount of educative work is still needed. A vast majority of people in some of the underdeveloped countries have to subsist on poor and inadequate diet while at the same time enormous quantities of food material rich in valuable protective constituents are allowed to be wasted or misused. It is the function of food technology to conserve this and make it available to all sections of the people. Foodstuffs are highly perishable and seasonal. There is often a surplus in the season of plenty particularly in the areas of production. Due to seasonal abundance and various bottlenecks in handling and transportation and other causes the foodstuffs are not all consumed immediately after they are produced but suffer deterioration to different extent. They are subjected to various kinds of damages such as depredation by rodents, insects and pests and microorganisms. If highly perishable items such as meat are not consumed quickly, they get putrefied. An interesting story is told as regards how in Europe spices came into use for disguising the unpleasant flavour of stale meat[1]. The spoilage of food in the hot and humid areas of the tropical countries is characteristically high. Therefore, it is not merely enough to produce the needed quantity of food but it must be properly taken care of until consumed. This is also interlinked with the question of providing an efficient and speedy transport system. Modern civilisation has very often to rely on foods produced in distant areas. Food transport and food preservation are closely linked and in many instances one would be impossible without the other[1]. Moreover, a well-developed food industry concerned with food preservation and processing would provide a steady market for various foodstuffs, facilitate storage and transportation, enable full advantage to be taken of seasonal abundance and help to fill the gaps in the supplies of various kinds of foods in areas and in seasons in which there is a shortage. Food preservation is thus an essential link between food production and consumption.

India's food supplies are at present inadequate to meet fully the needs of an optimum diet for the existing population. At the same time, the population, which is already high being 441.80 millions (in 1961), is increasing at a rapid rate of over 2% every year. Protective foods rich in proteins, vitamins, minerals, and other essential food factors are particularly in short supply. The dietary habits of the people are such that the bulk of the calories is derived from foodgrains. Fruits, vegetables, milk, meat, fish, eggs and other protective foods form only a very small proportion in the average Indian dietary. The per capita income[2] is very low being of the order of Rs. 330 per annum (in 1960-61). Over 80% of the people live in villages and follow traditional habits and customs. The literacy[3] is also low being 23.7% (in 1961). The per capita availability of cultivable land is so low and the socio-economic conditions obtaining in the country are such that even though there is potentiality for increasing the production, it will be difficult to keep pace with the growing pressure of population on land. Therefore, apart from other measures that are taken to meet the situation, there is urgency in promoting conservation of the available foodresources. The food so saved will itself contribute to a substantial increase in availability and improvement in nutrition.

THE FOODS TO BE PRESERVED.

The position regarding raw materials that have to be preserved and properly utilised is indicated briefly in Table 1. Even though the per capita availability of the food items is generally inadequate, India has large supplies of raw materials that have to be handled, suitably treated and distributed. India is one of the countries having a large livestock population (Table 2). It has large, though still insufficient, resources of oilseeds. A wide selection of fruits and vegetables many of which are indigenous to the country is also available. The indigenous resources of packing materials are also considerable. The country has, therefore, the potentiality for developing a flourishing food preservation and processing industry. But in view of the peculiar socio-economic situation obtaining in India the treatment given to natural foods should be the minimum that is essential. While expensive modern techniques may have to be applied for items meant for export, reliance will have to be placed largely on traditional methods and other simple techniques for meeting the local needs.

TRADITIONAL METHODS OF FOOD PRESERVATION.

There are several traditional methods of food preservation and processing in vogue in India. Some of the traditional processes have been put on scientific basis but there are several others the scientific rationale of which has not been fully worked out.

Pickle[4] constitutes an important section among the indigenous fruit and vegetable products. Mango, lime, amla, chilli, tomato, carrot, turnip, cauliflower, etc. are among the popular materials used for pickling. Both sun-dried and fresh fruits and vegetables are used. They are of two important types, namely oil-pickles and vinegar-pickles. The edible oils that are commonly used in oil-pickles are mustard, groundnut and sesame. The pickles are generally packed in earthenwares, glass jars, mud vessels and wooden barrels.

Chutney[4] is another product prepared from fruit and vegetables by cooking in sugar syrup with salt, spices and vinegar to a thick consistency. Mango is one of the most important fruits used for chutney.

The Indian preserves and murabbas[4] are made from certain fruits and vegetables by applying the principle of high sugar concentration for preservation. Amla, apple, ginger, petha, pear, carrot, pine apple, etc. are among the important preserves. The indigenous system of medicine, specially the Unani system, claims several medicinal properties for the Indian preserves.

Sun drying[5] has been one of the common methods of preservation practised in India for centuries. Highly perishable fruits and vegetables, roots and tubers, fish and several other products have been preserved in this manner. Mango, bitter gourd, okra, tomato

jack fruit, bread fruit, beans, sweet potato, potato and tapioca are some of the commonly known dried products. There has been a revival of interest in this technique in recent years and some commercial units have sprung up. Dried ripe banana is one such commercial product.

A class of indigenous paste goods, known as papads, is widely known. The raw materials used are Bengal gram, green gram, rice or potato flours. The papads can be baked on hot cinders or deep fried. A variety of other paste goods and macaroni like products are also in use. Sun drying is adopted in all these instances.

Sweet-meat or the Indian indigenous confectionery industry is largely functioning in the unorganised sector. A very large variety of sweets are known. Some of the main ingredients used are Bengal gram flour, wheat flour, rice flour, milk and milk products, shredded coconut, oil, ghee (clarified butter), sugar, nuts and oilseeds. The two most familiar varieties of sweets are 'Rasagola' - a product made from milk and 'Halwa' a product that uses wheat flour.

Parboiling of rice is a technique that is believed to have originated in India. It has been shown that parboiling of paddy (rough rice) would be of great value for obtaining greater yield during milling and for conserving nutrients. The traditional methods have been greatly improved in India by researches undertaken at the Central Food Technological Research Institute, Mysore (CFTRI) and the Jadavpur University at Calcutta, whereby the processing time has been reduced considerably to yield an improved product richer in nutrients, better in storage properties, and more agreeable in appearance and flavour. It has been estimated that if all the rice produced in India is parboiled, about half a million tons more of head rice would be available for consumption[5]. The improved techniques are being popularised and extended for achieving the desired objectives.

Some of the traditional methods of processing could be improved and made use of for achieving food preservation on a large scale.

FRUIT AND VEGETABLE PRESERVATION.

India produces a great variety of fruits, squashes, jams, pickles, murabbas, chutneys, etc. for home consumption as well as for export. Pine apples, mangoes, guavas, oranges, pears, litchis, peaches and papayas are some of the important types of fruits canned. Among the vegetables, the items commonly canned are cauliflower, cabbage, spinach, peas, okra, bitter gourd, French bean, tomato and curried vegetable. It is expected that the present annual production of about 40,000 tonnes of processed fruits and vegetables would increase to one hundred thousand tonnes by 1966. The quality of the products is controlled by the Fruit Products Order, 1955 administered by the Ministry of Food & Agriculture, Government of India, which prescribes minimum standards of quality and hygienic conditions. A close check on the quality of the products is maintained through technically qualified officials of the Government. Approximately 90% of the

production is carried out by small scale units. The industry has an organised sector which is developing rapidly on modern lines. There are a variety of typical Indian products that have attained a high reputation in international markets. The industry has already established an export market in spite of the high cost of production. Potentialities of accelerated freeze-drying technique are also being explored.

An intense campaign is being organised with short-term courses, demonstrations, fairs, exhibitions, etc. for the promotion of home scale food preservation.

Techniques are being developed to extend storage life of fruits and vegetables at ordinary temperature through control of respiration, enzymatic degradation and microbial attack while, at the same time, retaining all the desirable features of the fresh material. The CFTRI has found that the high melting component (melting point of over 75°C) of sugarcane wax is very useful as an emulsion for the purpose. The emulsion can also serve as a carrier for safe fungicides and growth regulators. Wax emulsion formulations have been evolved and conditions of treatment standardised for several fruits and vegetables. Measures are being taken for extending the application of the technique on a large scale.

PROTEIN TECHNOLOGY.

An approach that is being developed in India concerns the salvaging for human consumption of vegetable proteins from hitherto inadequately used resources such as oilseed-meals. Oilseeds, such as groundnut, sesame, mustard and coconut are processed in India primarily for vegetable oils. But the residual cakes resulting as a by-product of the vegetable oil industry is rich in protein, containing as high as 50% by weight of protein. As a result of studies undertaken over a period of years, the CFTRI has standardised the production and use of edible quality meals from peanut which is one of the most important oilseeds of India. The Government of India have already taken a lead in setting up with UNICEF assistance two units of capacity of 3,000 tons each per annum for the production of edible groundnut flour. The units are under erection and are expected to go into production shortly. The groundnut flour could be used in the preparation of a variety of foodstuffs such as protein-rich wheat flour, protein-rich biscuits etc. The CFTRI has also developed a high protein supplementary food from groundnut flour, incorporating with it a certain percentage of chick-pea meal and some amount of essential minerals and vitamins. These low-cost food preparations have been shown to be effective in overcoming protein mal-nutrition in India.

The CFTRI has also successfully evolved methods for the preparation of protein isolates by the direct processing of oilseeds to yield a high grade oil, together with quantitative yield of protein and other components without the use of solvents. Using such a protein from peanuts with about 95% purity, several formulations have been evolved with and without the addition of a certain percentage of

milk powder and with added dextrimaltose vitamins and minerals which can be utilised in the same way as milk. A more recent development in the line is the conserving of coconut proteins.

The CFTRI has taken up a programme of further work on exploring protein resources with the assistance from the National Institute of Health, USA.

Successful utilisation of buffalo milk in the production of infant foods has been facilitated by the work of the CFTRI[7]. The buffalo milk protein shows less stability during concentration and drying than cow's milk. This difficulty has been overcome by suitable addition of buffers such as are already present in milk. The process has been utilised by one of the large-scale milk processing units in India for production of infant foods based on buffalo milk.

There are various programmes for conserving milk[2].

Meat Technology is in its early stages of systematic development.

FISH PRESERVATION.

The annual catch of fish in India is of the order of 1.4 million tonnes of which about two-thirds comes from the sea and the rest from inland resources.

Efforts have been made during recent years to increase the facility for catching, storage, transportation and processing of fish. Mechanically operated vessels have been introduced in many important places to reduce the time lag between catching and landing. The use of ice for cooling the fish is being adopted in many places. A number of ice factories and cold storages have been established at important centres. Insulated road vans and carrier launches have been introduced recently at several centres. Some improvements have also been effected in packing of fish and fish products, with the object of minimising spoilage and wastage. Low cost containers have been developed which protect fish from physical injury during transport and handling and which at the same time act as heat insulators.

The chief methods of preservation practised in the country are (1) Sun-drying; (2) Salting and sun-drying; (3) Wet-salting; (4) Pit curing; and (5) 'Colombo' curing. Fish canning is carried out only on a small scale. The main obstacles in the way of development have been irregular supply of fish, lack of good and cheap containers and short duration of the canning season. Because of high cost of processed product, the canned fish is not within the reach of the average Indian. A method has been worked out at the CFTRI for the production of edible fish flour from oil sardine.[8] A nutritious product containing about 15% to 20% protein has also been developed from a blend of equal quantities of fish flesh and a starchy material like tapioca.

The CFTRI and the Fishery Research Laboratories maintained by the Central and State Governments are engaged in a series of researches designed to improve the techniques of production, preservation, packaging and transportation of fish. The production of fish is expected to increase to 1.8 million tonnes by 1966. Fish is already a valuable export item in India.

IMPROVED PACKAGING, TRANSPORT AND STORAGE OF PERISHABLES.

The bulk of the highly perishable foods in India is produced at locations away from large centres of consumption. The production centres are not easily accessible by roads or rail. Some of the articles have to be transported hundreds of miles before they can fetch a reasonable price. Facilities for transport such as ventilated wagons for fruits and vegetables and refrigerated wagons for fruits, fish and other items are inadequate. Transport of perishables by air is rare, but there is a lot of scope in this direction. The products are carried usually as headloads by primary producers or in animal-driven carts and less frequently in lorries and trucks to the nearest collection centres. The products are largely disposed of at these centres. Small amounts are transported by organised trade to larger metropolitan centres in carts, trucks or trains. Jute bags, bamboo and wicker baskets and wooden crates of different shapes and sizes are largely used for packing perishable commodities. Mud pots, palmyra mats and other improvised packages are also used for a variety of purposes. The dimensional stability and ability to withstand stacking need to be improved so that they could be made strong enough to withstand rough handling. Cushioning materials used include husk, straw, saw-dust and the like. Use of refrigerated transport is available only to a very negligible extent and is mostly confined to fish and milk. Packages in India are not generally standardised. Defence Services, however, accept articles only when packed in standard packages for which specifications are available. The newly formed Division of Packaging at the CFTRI[8] is studying a number of local problems, the solution of which is designed to save considerable amount of perishables which is at present damaged. Efforts are being directed towards (i) increasing the production of packaging materials; (ii) improving the existing packages; (iii) developing new packaging materials from locally available raw materials suitable to the different kinds of foodstuffs and to the different conditions of transportation and handling; (iv) standardising packages; (v) pre-treating of perishable foods; (vi) pre-packaging of perishables; and (vii) developing proper packages for goods intended for export.

COLD STORAGE AND REFRIGERATION.

India does not have adequate cold storage and refrigeration facilities. There are at present over 200 cold stores in the country with an average capacity of 670 tonnes. Most of the cold stores situated in inland towns have been storing mainly potatoes but cold stores in port towns like Bombay, Calcutta and Madras are basically multipurpose, where a wide range of commodities like fish, meat, liver, apples, etc. are stored. Optimum conditions of refrigerated

preservation of a variety of Indian fruits and vegetables have been worked out[8]. Some data have also been collected on the frozen storage of fruit products. The chief difficulty standing in the way of expansion of cold storage of perishable foods in India is the lack of adequate equipment, some components of which have to be imported.

DEVELOPMENT AND EXTENSION.

There is at present a wide gap existing between theory and its practical application in the field of food preservation and nutrition. This is partly so because the task of getting popular acceptance for a new technique or a new product in India is tremendous. To fill up this gap, a Food Extension Service is being established by the Government of India which will inter alia undertake a systematic and intense campaign with the aid of a fleet of properly equipped and staffed mobile vans for the application of food preservation, prevention of wastage, promotion of diversification of the dietary habits, popularisation of low-cost balanced diets and spreading knowledge concerning scientific techniques of cookery and utilisation of food. These units will keep liaison with the various training centres, research organisations, teaching institutions and other agencies concerned with food and would function as the focal points for the dissemination of the scientific information on food.[9] There is a special technical division dealing with such and allied matters in the Ministry of Food and Agriculture. This division initiates programmes for suitable application of the results of research and other developments in the field of Food and Nutrition, with the advice of "the Scientific Food Advisory Panel" constituted by the Government of India.[5]

CONCLUSION.

A systematic approach is thus being made for the judicious application of science and technology for achieving efficiency in food conservation. Some of the measures are designed to promote the traditional methods of preservation. Some are concerned with adapting modern techniques to suit local conditions. Others are largely new and experimental lines developed in India.

TABLE - 1*

Production of Foods in India (Thousand metric tonnes/year)

FOODS		1951-52	1960-61
1. Cereal			
Rice		21,729	34,241
Wheat		6,270	10,819
Others		17,005	22,817
	Total:	45,004	67,877
2. Pulses			
Gram		3,441	6,307
Others		5,102	6,360
	Total:	8,543	12,667
3. Roots & Tubers			
Potatoes		1,712	2,699
Cassava		1,262	1,781
Sweet Potato		1,203	1,281
	Total:	4,177	5,761
4. Sugar		6,163	8,829
5. Nuts & Seeds			
Groundnut		3,192	4,424
Sesamum		452	293
Coconut		2,019	2,722
Rapeseed		943	1,402
Linseed,		333	417
	Total:	6,939	9,258
6. Fish		700	1,422

TABLE - 2*

Livestock population in India (thousands)

	1951	1961
Total Cattle	155,295	175,672
" Buffaloes	43,400	51,137
" Goats	47,155	60,813
" Sheep	39,052	40,263
" Pigs	4,486	Not available
" Poultry	75,548	116,914

*Source: - Directorate of Economics & Statistics, Ministry of Food & Agriculture, New Delhi.

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V. SUBRAMANYAN: Director, CFTRI, Mysore

S U M M A R Y

In underdeveloped countries, a large section of the population subsists on deficient and inadequate diet, while considerable food material rich in nutrients is wasted and spoilt. A well-developed food preservation industry will salvage this loss for human consumption, facilitate storage and transportation and even out the seasonal glut to make it available in areas and seasons of shortage. The food so saved will itself contribute to a substantial increase in availability. Food preservation is thus an essential link between production and consumption. The treatment given to natural foodstuffs in India has to be the minimum necessary to facilitate handling, transportation and preservation as it is conditioned by the low per capita income, the influence of traditions and habits and other socio-economic factors. Traditional methods, such as sun-drying, parboiling, pickling, preserves making etc. have, therefore, an important role to play.

The Fruit and Vegetable Preservation Industry is developing rapidly in India to meet the internal and export demands. The quality of the products is controlled under the Fruits Products Order 1955, administered by the Government of India. Wax emulsion formulations based on sugarcane wax and conditions of treatment have been standardised for extending the storage life of fruits and vegetables at ordinary temperature.

Efforts are being made for salvaging for human consumption vegetable proteins from resources such as oilseed-meals. Two units with a capacity of 5,000 tons each per annum are being established for the production of edible groundnut flour by the Government of India in collaboration with the UNICEF and private enterprise. Protein-isolates have also been recently developed from peanuts. The work is being extended to other vegetable protein resources. A process has been developed for the preparation of buffalo-milk powder for use in infant foods.

Fish preservation is being developed as an important industry for meeting internal as well as export needs. Emphasis is being placed on improved techniques of production, handling and preservation. Extensive researches are being sponsored by the Government for the rapid development and modernisation of the industry. Research work is in progress for developing suitable packages for the different kinds of foodstuffs to withstand the varying conditions of transportation and handling.

A Food Extension Service is being established by the Government of India for undertaking a systematic campaign, with the aid of a fleet of mobile vans, for the application of food preservation, promotion of diversification of the dietary habits, popularisation of low-cost balanced diets, dissemination of scientific information on food and collection of food consumption data. The service is designed to bridge the gap existing between theory and its practical application in the field of food preservation.

A systematic approach is thus being made for the judicious application of science and technology for the promotion of diversification in production, effective utilisation and efficiency in preservation. Some of the measures are designed to improve and promote the traditional methods of preservation. Some are concerned with adapting modern techniques to suit local conditions. Other are largely new and experimental lines developed in India.

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